World Applied Sciences Journal 19 (3): 370-375, 2012
ISSN 1818-4952;

DOI: 10.5829/idosi.wasj.2012.19.03.691

Nutritional Facts and Free Radical Scavenging Activity of Turnip (*Brassica rapa*) From Pakistan

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Abstract: It has been noticed that increasing the consumption of fruits and vegetables is a practical strategy for consumers to optimize their health and to reduce the risk of chronic diseases. Turnip (*Brassica rapa*) is one of the oldest cultivated vegetables that has been used for human consumption since prehistoric times. It is a rich source of vitamin C and anti-oxidants which possess the ability to protect the body from damage caused by free radical induced oxidative stress. In the present study the nutritional facts and the antioxidant capacity were evaluated. From this study it was found that white turnip had low calories (29.61 Kcal/100g) but high fiber (3.14± 0.92 g/100g), while the yellow turnip had (26.48 Kcal/100g) and fiber 2.90 ± 0.76. The 80 % methanol extract of yellow turnip showed highest radical scavenging activity (23.2-72.1%) than white turnip (18.3-65.2%) at 0.5-2.5 mg/ml and same trends were found in reducing power activity assay. The data obtained in the *in vitro* models clearly establish the antioxidant potency of *Brassica rapa* (turnip) extracts.

Key words: Nutritional facts · DPPH · RPA · *Brassica rapa*

INTRODUCTION

Fruits and vegetables are primary food sources providing essential nutrients for sustaining life. They also contain a variety of phytochemicals such as phenolics and flavonoids, which provide important health benefits. Hence, regular consumption of fruits and vegetables is associated with reduced risks of chronic diseases, such as cancers and cardiovascular disease [1,2]. Antioxidants retard or inhibit the oxidation possibly by reactive radicals including ROS in a biological system. Oxidation is a chemical reaction that transfers electrons from a substance to an oxidizing agent. Oxidation reactions can produce free radicals, which start chain reactions that damage cells. Antioxidants neutralize free radicals including hydrogen peroxide (H_2O_2), superoxide (O^{-1}), hydroxyl (OH), peroxyl (ROO) by different mechanism including metal chelation and electron donation as reducing agent [3].

Turnip (*Brassica rapa var*) belong to family *Cruciferae* or *Brassicaceae* and it is one of the oldest cultivated vegetables that has been used for human consumption since prehistoric times. This vegetable is usually grown in regions that experience temperate climates. Turnip has high quantity of vitamin C and anti-oxidants which may help to curb the free radicals and destructive oxidation reactions. It is beneficial in lowers the risk of obesity, high blood pressure, diabetes and cancers of the stomach, pancreas, bladder and lung. This species has been previously studied for the phenylpropanoids [4], volatile constituents [5], allozymes [6] of the leaves, glucosinolates from the flower buds [7], tuberization ability of the epicotyl [8] and fatty acid composition of the seed oil [9]. The present study was designed to investigate the nutritional attributes (Proximate analysis) and the antioxidant activity of turnip (*Brassica rapa*) by two different method i.e. DPPH assay and reducing power activity assay.

MATERIAL AND METHODS

Collection of Samples: Two varieties of turnip (*Brassica rapa)* white and yellow were collected from local market of Lahore Pakistan.

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Pretreatment of Samples: White and yellow samples of *Brassica rapa* were taken and peel and pulp were separated. These were sliced and were dried in an oven at 60°C and ground to fine powder. Both samples of white and yellow turnip were packed in polythene bags for further use of nutritional facts and antioxidant activity.

Extracts: For antioxidant activity of *Brassica rapa* (turnip) the 10 g sample of both varieties was mixed with 80 % methanol shacked well and filtered it. Further dilution was made for estimation of free radical scavenging activity and reducing power activity.

Nutritional Analysis: Nutritional analysis of *Brassica rapa* (turnip) were evaluated according to AOAC methods [10].

Free Radical Scavenging Activity (DPPH): DPPH assay was done according to the method of [11] with some modifications. Briefly 100 micro liter (ul) of standard antioxidant BHA and two varieties of *Brassica rapa var* (concentration 0.5-2.5 mg/ml) of each in their respective test tubes containing 3 ml of DPPH reagent. These were incubated for about 30 minutes. Spectrometric measurements were made using methanol as blank. A calibration curve at 517 nm was made with DPPH. Antioxidant activity was expressed as % inhibition. The purple colored DPPH is a stable free radical, which is reduced to 2,2-diphenyl-1-picrylhydrazine (yellow colored) by reacting with an antioxidant [12].

Reducing Power Activity: The reducing power was determined according to [13] with slight modification [14]. The *Brassica rapa* water extract (0.25 ml) was mixed with 0.25 ml of 200 mM sodium phosphate buffer (pH 6.6) and 0.25 ml of 1% potassium ferricyanide. Then the mixture was incubated at 50°C for 20 min. After 0.25 ml of 10% trichloroacetic acid was added to the mixture to stop the reaction, the mixture was centrifuged at 3000 rpm for 10 min. The supernatant (0.5 ml was mixed with 0.4 ml of deionized water and 0.1 ml of 0.1% ferric chloride solution, allowed to stand for 10 min and the absorbance was measured at 700 nm.

Statistical Analysis: The experimental results will be expressed as mean ± standard deviation (SD) of three replicates.

RESULTS AND DISCUSSION

Plants from the *Brassicacae* family play a major role in worldwide vegetable production and consumption. *Brasica rapa* characterized by a particular bitter and pungent taste, The bitterness has been related to the content of some glucosinolate degradation products [15,16]. The consumption of *Brassica* vegetables has been related to human health and to reduction of the risk of certain cancers and cardiovascular diseases. This association is often attributed to the presence of glucosinolates (GLS), phenolic compounds and vitamins [17,18].

Nutritional Facts: *Brassica* foods are very nutritive, providing nutrients and health-promoting phytochemicals such as vitamins, carotenoids, fiber, soluble sugars and minerals, [19]. Proximate and nutrient analysis of edible fruit and vegetables plays a crucial role in assessing their nutritional significance [20]. The considerable use of vegetable species by the local people in their diet motivated to carry out the present proximate and nutrient analysis [21]. The nutritional value of white turnip and yellow turnip were depicted in Table 1. It was found that it had low fat and calories but high fiber. The values of moisture, ash, protein, fat and fiber were in line as those reported by [22], while the results of carbohydrates in present study were slightly lower. Such slight difference is expected to vary from variety to variety and region to region. The energy value of white turnip is slightly higher than yellow turnip variety.

Free Radical Scavenging Activity (DPPH): The antioxidants are related with their chemical structure that confers them redox properties. Free radical scavenging is one of the known mechanisms by which antioxidants

Table 1: Nutritional Values of *Brassica rapa*

Constituents	Percentages (%) of White Turnip	Percentages (%) of Yellow Turnip
Moisture	88.90 ± 1.05	90.03 ± 1.2
Ash	0.82± 0.14	0.70 ± 0.16
Fat	0.21± 0.05	0.20 ± 0.05
Fiber	3.14± 0.92	2.90 ± 0.76
Protein	1.12± 0.20	1.16 ± 0.25
Carbohydrate	5.81± 0.58	5.01 ± 0.52
Energy (Kcal/100g)	29.61	26.4

Data are presented ± SD

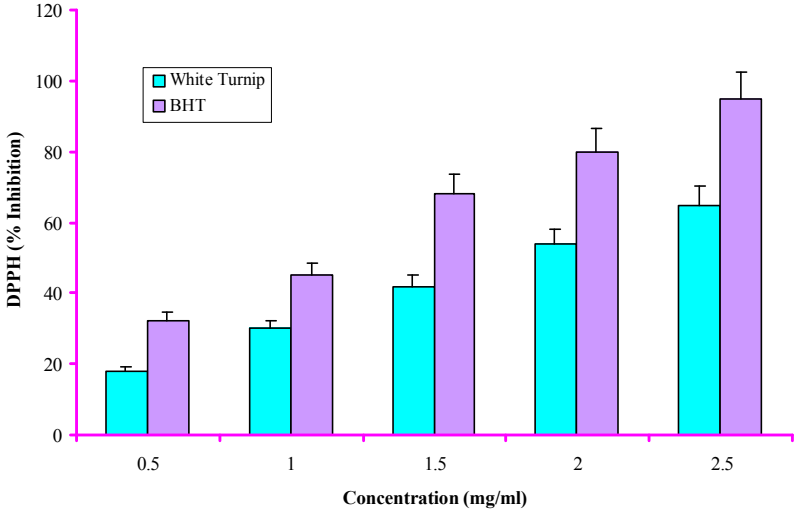

Fig. 1: DPPH (% Inhibition) of White Turnip and BHT

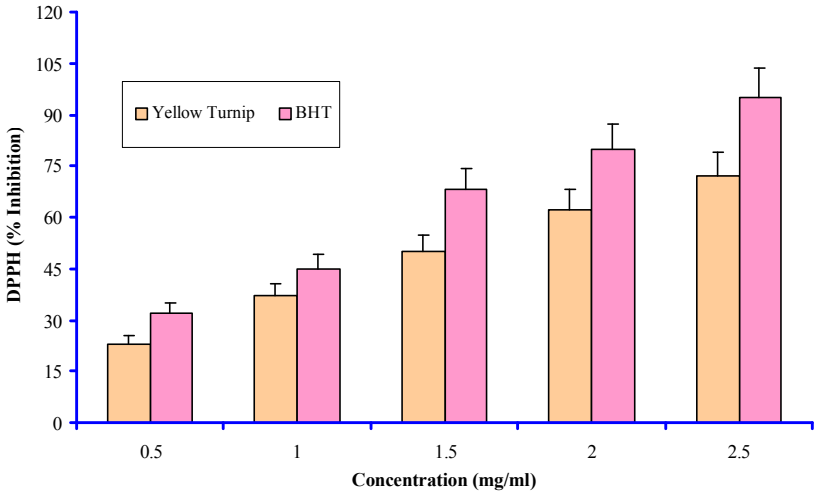

Fig. 2: DPPH (% Inhibition) of Yellow Turnip and BHT

inhibit lipid oxidation. The method of scavenging DPPH free radicals can be used to evaluate the antioxidant activity of specific compounds or extracts in a short time. The DPPH assay is considered a valid and easy assay to evaluate radical scavenging activity of antioxidants, since the radical compound is stable and does not have to be generated as in other radical scavenging assays. When it reacts with hydrogen donors, the DPPH radical is reduced to the corresponding hydrazine; a decrease in absorbance at 517 nm is produced by the addition of the antioxidant [23]. DPPH is a stable free radical and the color of the reaction mixture changes from purple to yellow. Antioxidants, on interaction with DPPH, either transfer electrons or hydrogen atoms to DPPH, thus neutralizing free radical character [24].

The antioxidant potential exhibited by the turnip edible parts was determined by DPPH assay. Turnip edible parts displayed a concentration-dependent scavenging activity. The antioxidant activity % inhibition (DPPH) of white turnip was range from 18-65% (Fig. 1), while the antioxidant activity % inhibition (DPPH) of yellow turnip were range from 23-72% (Fig. 2) at concentrations (0.5-3.0 mg/ml). The antioxidant activity % inhibition (DPPH) of synthetic antioxidant BHT was range from 35-95% at same concentration. From these results it was found that the antioxidant activity of yellow turnip is higher than white turnip.

When comparing these results with those obtained from given literature [25] in the same assay for *B. oleracea var costata*, it could be noticed that turnip flower buds exhibits higher antioxidant capacity than turnip roots. [26]

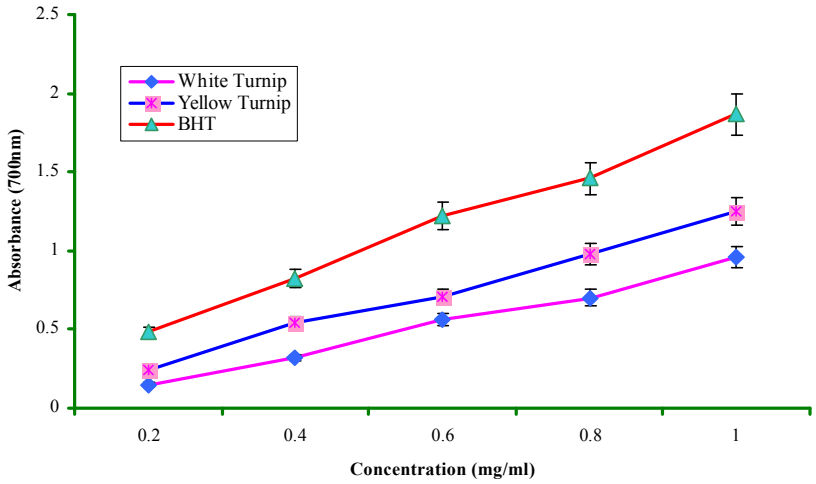

Fig. 3: RPA of *Brassica rapa* and BHT

isolated 14 phenolics compounds from edible part of turnip (3-p-coumaroylquinic, caffeic, ferulic and sinapic acids, kaempferol 3-O-sophoroside-7-O-glucoside, kaempferol 3-O-sophoroside-7-O-sophoroside, kaempferol 3-O-feruloyl/caffeoyl)-sophoroside-7-O-glucoside, kaempferol 3,7-O-diglucoside, isorhamnetin 3,7-O-diglucoside, kaempferol 3-O-sophoroside, 1,2-disinapoylgentiobiose, 1,20-disinapoyl-2-feruloylgentiobiose, kaempferol 3-O-glucoside and isorhamnetin 3-O-glucoside) and six organic acids (aconitic, citric, ketoglutaric, malic, shikimic and fumaric acids). Thus, it seems that phenolics represent the main contribution for the resulting effect that showed the highest antioxidant potential [27]. In addition, vitamin-C and hydroxycinnamic acids/their derivatives [28], flavonol glycosides [29], or organic acids [30], are present in turnip which are responsible for this antioxidant activity.

Reducing Power Activity (RPA): The reducing capacity of the plant extract components may serve as a significant indicator of its potential antioxidant activity [31]. A higher absorbance indicates a higher ferric reducing power. This method is based on the reduction of ($Fe3^{+}$) ferricyanide in stoichiometric excess relative to the antioxidants [32]. Figure 3 shows the reducing powder of both verities of turnip extracts compared with BHT. The reducing power activity was determined by absorbance of different concentration like 0.2, 0.4, 0.6, 0.8, 1.0 mg/ml. Yellow turnip extract displayed a higher reducing power compared to the white turnip extract. Reducing powers of yellow turnip extract was 1.25, whereas that of white turnip extract was 0.96 at 1mg/ml. However, BHT showed increase in reducing powers from 0.48 to 1.87 at 0.2-1.0 mg/ml. These results were in close agreement to those depicted by [33]. With regards to reducing capacity, higher reducing powers might be attributed to higher amounts of total phenolic compound [34]. Different studies have been indicated that the reducing properties are generally associated with the presence of reductones, which have been shown to exert antioxidant action by breaking the free radical chain by donating a hydrogen atom [35]. Hence, yellow turnip extract may have the highest amounts of reductones and polyphenolics.

CONCLUSION

In conclusion, *Brassica rapa* (turnip) are very nutritive and its extracts was found to be an effective antioxidant in two different vitro assays including: DPPH and reducing power activity.

ACKNOWLEDGMENTS

The authors would like to express their gratitude to Food and Biotechnology Research Center (FBRC), PCSIR Labs Complex, Lahore, Pakistan for providing all the facilities during this period of work.

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